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(71) Applicant *(for all designated States except US)*: D&D RESEARCH AND DEVELOPMENT LIMITED [IE/IE]; 44 The Hawthorns, Abberley, Killiney, County Dublin (IE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : COSTELLO, Timothy [IE/IE]; W3 Ballymount Drive, Dublin 12 (IE). NYHAN, Daniel [IE/IE]; 44 The Hawthorns, Abberley, Killiney, County Dublin (IE). O'NEILL, Richard [IE/IE]; 20 Landscape Crescent, Churchtown, Dublin 14 (IE). HANLEY, Malachy [IE/IE]; Monknewtown, Slane, County Meath (IE).

(74) Agents: O'CONNOR, Donal, H. et al.; Cruickshank & Co., 1 Holles Street, Dublin 2 (IE).

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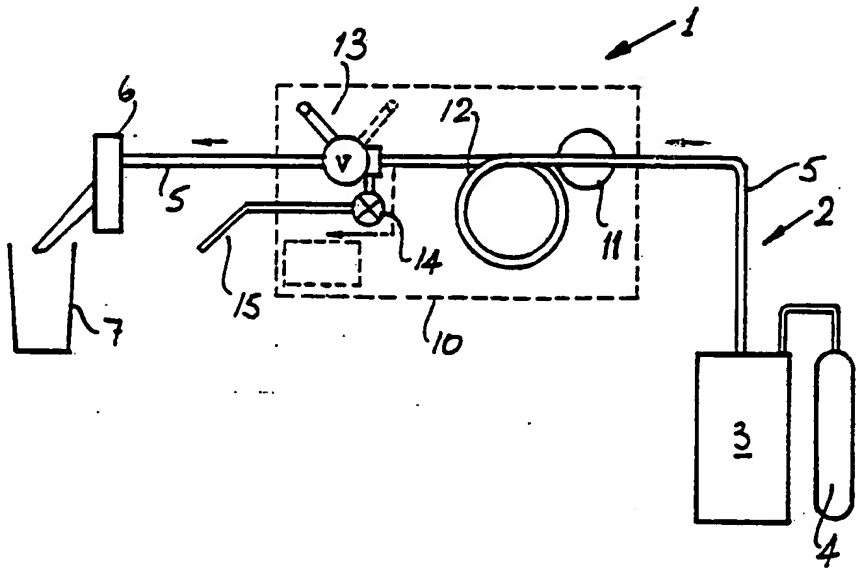
(54) Title: BEER FOB DETECTION SYSTEM



(57) Abstract

Beer wastage on change-over of a keg is prevented by using a fob detection system (1) which is completely hygienic. The system (1) allows the passage of cleaning pellets for a beer line. The system (1) has a capacitive sensor (11) which detects the dielectric constant value of the contents of the beer line according to the magnitude and frequency of oscillation set up in an electrostatic field by a capacitive electrode. A shut-off valve (13) is of the ball valve type and does not provide any spaces or crevasses within which bacteria may grow. A fob bleed valve (14) is incorporated in the shut-off valve (13).

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BEER FOR DETECTION SYSTEM

The invention relates to beer dispensing, and more particularly to the reduction in an hygienic manner of beer wastage caused by fob in beer lines.

Carbonated beer is usually stored in stainless steel or aluminium kegs, the most common size having a capacity of 50 litres. Beer is dispensed by placing a tapping head on the keg and when this is opened, dispensing gas such as carbon dioxide or a mixture of carbon dioxide and nitrogen under pressure enters the keg and presses down on the beer forcing it up through a central tube to the tapping head. The beer flows through the tapping head and a beer line to the dispensing tap. Wastage of beer occurs when the keg runs out of beer and the dispensing gas mixed with beer froth (referred to as "fob") reaches the dispensing tap. In some instances, up to 2.5 litres of beer may be wasted after connection of a fresh keg.

To overcome this problem, fob detectors have been developed which detect fob flowing in the beer line and shut off flow to the dispensing taps. Such detectors are described in British Patent Specification Nos. GB 1357953, GB 1384607 and GB 2081223. These detectors have a float chamber having a float or bobbin which drops down over an opening to prevent beer flow when there is only fob in the chamber. Such detectors suffer from the disadvantage that they make it difficult to maintain hygienic conditions in the beer line. The float chambers may act as dirt and bacteria traps and are difficult to clean efficiently. Indeed, it is desirable to clean beer lines by passing cleaning pallets through the line and this is impossible if the float chamber is installed.

Not all fob detectors are based on the float chamber principle. In the United States Patent Specification No. 4406382, a detector is described which includes metal probes in side chambers of a beer line. These probes contact the beer and the current between the probes is used as an indication of contents of the beer line. Again, however, the side chambers in which the probes are installed could act as bacteria traps and cleaning of the beer line would be difficult. Finally, British Patent Specification No. GB 2236180 describes a method of detecting bubbles in a liquid such as beer which includes an opaque barrier within a beer line which is used in conjunction with a light emitter and a light receiver to determine the contents of the beer line. Again, however, the opaque barrier intrudes into the beer line and this system also includes a separation chamber for gas entrapment. This chamber also provides discontinuity in the beer line from the keg to the dispensing tap and could act as a dirt and bacteria trap, particularly in view of the difficulty in cleaning.

The invention is directed towards providing a beer fob detection system which does not intrude into the beer line so that hygiene of the beer line may be maintained in an easy and simple manner. A related object is that the beer lines may be cleaned by pellets.

According to the invention, there is provided a beer fob detection system comprising a fob sensor and a valve means operatively connected to the sensor, characterised in that:-

the sensor is a capacitive sensor and comprises means for determination of fob presence in a beer line according to a capacitive property of the contents of the beer line.

In one embodiment, the capacitive property is the dielectric value of the contents of the beer line.

Preferably, the valve means comprises a shut-off valve constructed to provide an internal duct surface having a smooth transition with the internal surface of the beer line.

The valve is preferably a ball valve.

Ideally, the system further comprises a fob bleed valve.

In one embodiment, the fob bleed valve is incorporated in the shut-off valve.

In another embodiment, the sensor is constructed to output a signal indicating fob presence when dielectric value of contents of the beer line drops below a value in the range of 10.0 to 20.0.

Ideally, the capacitive sensor has an operating frequency in the range of 2 to 5 KHz.

In a further embodiment, means are provided for adjusting sensitivity of the capacitive sensor by providing for adjustment of negative feedback between an amplifier and an oscillator driving a capacitive electrode.

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a diagrammatic view of a beer dispensing system incorporating a fob detection system of the invention;

Figs. 2, 3 and 4 are perspective, front and plan views respectively of the fob detection system;

Figs. 5a and 5b are diagrammatic cross-sectional views showing shut-off and bleed valves of the fob detection system at different positions;

Fig. 6a is a diagrammatic view of the electronic circuit of the system, and Fig. 6b is a detailed block diagram of the sensor;

Fig. 7 is a graph showing the response of a capacitive sensor of the system;

Fig. 8 is a diagrammatic view showing the manner in which a bank of fob detection systems may be connected;

Fig. 9 is a diagrammatic view showing an alternative fob detection system of the invention; and

Figs. 10(a) to 10(f) are drawings showing an alternative construction of valve for the fob detection system.

Referring to the drawings, and initially to Fig. 1, a fob detection system 1 of the invention is shown connected in a beer dispensing system 2. The beer dispensing system 2 comprises a keg 3 of beer which may be beer, lager or stout and this is connected to a cylinder 4 for dispensing gas which is used for pressurising the beer in the keg 3. A beer line 5 runs through the fob detection system 1 and

out to the dispensing tap 6, shown dispensing into a glass 7.

Referring now to Figs. 3 to 7 inclusive, the fob detection system 1 is shown in detail. The system 1 comprises a rectangular housing 10 in which is mounted a capacitive proximity sensor 11. The beer line 5 runs through the housing 10 and it forms a loop 12 downstream of the sensor 11, before it is connected to a valve means, namely, a shut-off valve 13 and a fob bleed valve 14, which is in turn connected to a fob bleed outlet duct 15.

In more detail, the shut-off valve 13 has a handle 19 on a control spindle 20, which is biased by a torsion spring 21 in the anti-clockwise direction as viewed from above. The spindle 20 carries a control arm 22, the position of which is detectable by a microswitch 23. A vertically-movable control rod 24 is mounted adjacent to the valve 13. This is biased upwardly by a compression spring 25, and is surrounded beneath the spring 25 by a solenoid 26.

Referring in particular to Figs. 5a and 5b, the construction of the shut-off valve 13 and the bleed valve 14 is shown. The shut-off valve 13 is a ball or cock valve, having a bore 30 which is the same as the internal diameter of the tube so that while beer is flowing, it presents a continuous internal surface to the beer. The bleed valve 14 comprises a valve biassed by a coil spring 32 to the closed position. A pivotally mounted handle 33 is provided for moving the valve to the open position to allow escape of fob after closure of the shut-off valve 13. The valve seat has a 3° taper.

Referring now to Figs. 6a and 6b, the electrical circuit of the system 1 is shown in more detail. Parts similar to those described with reference to the previous drawings

are identified by the same reference numerals. The circuit is indicated by the numeral 40 and includes a 12 Volt DC rail 41 which activates a light emitting diode (LED) 42 when the system 1 is in operation. Switching of the solenoid 26 is achieved by a relay switch 44 which is connected to the microswitch 23.

Referring now to Fig. 6b, the circuit of the sensor 1 is shown in more detail. The sensor 1 comprises a floating base electrode 50 which is connected to an oscillator 51, which is in turn connected to an amplifier 52. The output of the amplifier 52 is connected to a rectifier 53, which is in turn connected to a trigger circuit 54, which is also in turn connected to an output amplifier 55. The floating base electrode 50 acts as one capacitive electrode, while the subject material, in this case the contents of the tube acts as the other electrode and an electrostatic field is set up between them as shown in Fig. 6b. The type of the material and its dielectric properties in the electrostatic field affect the frequency and amplitude of the capacitive coupling back to the electrode 50. The operating frequency of the oscillator 51 may be in the range 2 KHz to 5 KHz and is in this embodiment 4 KHz. The sensing distance must be in the range of 3 to 30 mm.

An electrostatic field is generated by the oscillator 51 and the floating base electrode 50. Passage of beer, fob, or air in the tube (and therefore in the electrostatic field) causes interference which causes oscillation to begin. The oscillations are decoupled and rectified and the trigger circuit subsequently detects a certain current level and drives the output stage. The decoupling stage also generates a negative feedback signal, which opposes the starting-up of oscillation. A potentiometer (not shown) allows adjustment of the negative feedback, and

accordingly determines the sensitivity of the sensor. Thus, in summary, there are no oscillations when there is no object in the electrostatic field. However, in operation, the sensor is adjacent to the tube and there will always be oscillations caused by the tube itself. It is the amplitude and frequency of these oscillations which vary according to the dielectric constant of the material in the tube. As a general rule, the density of the material in the electrostatic field is approximately proportional to the dielectric constant. Accordingly, because the density of fob or other gas is significantly lower than that of pure beer, there is a very large difference in the dielectric constant and thus it is very easy for the sensor 11 to be set to differentiate one from the other. Referring in particular to Fig. 7, the constant for beer is in the range of 50.0 to 80.0, which of course varies, depending on whether the beer is stout, lager or conventional beer. However, foam is generally in the range of 5.0 to 15.0 and is typically around 10.0. Thus, in this embodiment the cut-off threshold for outputting a signal indicating fob is 15.0. However, as is clear from the graph, a different value may be used and indeed it could be much higher of the order of 20 to 30. A balance must be drawn between providing too early a signal, in which case beer may be lost and providing the signal too late, in which case fob may pass through the valve before it is shut-off.

In operation, when fob is not present in the line, the beer may flow in a continuous manner. As there are no side chambers or cavities within which dirt may become trapped and where bacteria may form hygiene is easy to maintain. For example, cleaning pellets may be pumped through the beer line from the keg to the dispensing tap and this cleaning action cleans the valve and is not interrupted by the valve. At this stage, the valve 13 is

at the position shown in Fig. 3 at which the spindle 20 is held in the on position against bias of the torsion spring 21 by action of the control rod 24 on the control arm 22. The control rod 24 is of course maintained at this position by the compression spring 25.

When fob is detected by the sensor 11, the amplifier 55 transmits a signal which causes the relay switch 44 to energise the solenoid 26. This causes the control rod 24 to retract thereby allowing the spindle 20 to rotate in the anti-clockwise direction under bias of the torsion spring 21. This closes the valve 13. The closed position of the control arm 22 is detected by the microswitch 23, which in turn de-activates the solenoid 26 to minimise current consumption. The compression spring 25 then returns the control rod 24 to the upper position.

It is now necessary to bleed off the fob between the tapping head and the valve 13 by opening the bleed valve 14 and closing it when beer from the next keg reaches the valve. To ensure that this is done, the electrical circuit may be configured to prevent opening of the valve 13 until beer appears again at the sensor. Alternatively, it is envisaged that the handle 33 of the fob bleed valve 14 may activate another microswitch connected in the circuit and which does not allow re-opening of the shut-off valve 13 unless the fob bleed valve 14 has been activated. Indeed, activation of the fob bleed valve 14 may be automatic and a relatively simple design change is all that is necessary to achieve this.

A very important aspect of the invention is that sensing of fob does not intrude on the beer line and thus, the beer may be dispensed from the keg to the dispensing tap without being allowed move into any separate chambers or cavities where bacteria may form.

Many different arrangements of fob detection system of the invention are possible, for example, as shown in Fig. 8 a bank of four or any desired number of the systems 1 may be connected in beer lines. As shown in Fig. 9, a switching unit 60 connected to capacitive sensors 11 at each of four or any desired number of lines 5 may not only shut off the relevant lines when fob is detected but may also open up another line so that switching between kegs of beer is carried out automatically. A fob bleed outlet 61 is shown and there is a single beer outlet line 62. Further, as shown in Figs. 10(a) to (f), alternative valves may be used. A valve 70 is shown which has a hollowed ball 71 with circular openings at right-angles in an internal duct 73. Position of the ball 71 is controlled by a handle 72 from below at an inlet 74 and exits to an outlet 75 in the beer line 5 at the first valve position. At the second position, the valve is completely shut off. At the third position, fob may exit to a fob bleed outlet 76. This is an extremely simple and hygienic construction of valve for this purpose.

The invention is not limited to the embodiments hereinbefore described, but may be varied in construction and detail.

CLAIMS

1. A beer fob detection system comprising a fob sensor and a valve means operatively connected to the sensor, characterised in that:-

the sensor is a capacitive sensor and comprises means for determination of fob presence in a beer line according to a capacitive property of the contents of the beer line.

2. A fob detection system as claimed in claim 1, wherein the capacitive property is the dielectric value of the contents of the beer line.

3. A fob detection system as claimed in claims 1 or 2, wherein the valve means comprises a shut-off valve constructed to provide an internal duct surface having a smooth transition with the internal surface of the beer line.

4. A fob detection system as claimed in claim 3, wherein the valve is a ball valve.

5. A fob detection system as claimed in any preceding claim, wherein the system further comprises a fob bleed valve.

6. A fob detection system as claimed in claim 5, wherein the fob bleed valve is incorporated in the shut-off valve.

7. A fob detection system as claimed in any of claims 2 to 6, wherein the sensor is constructed to output a signal indicating fob presence when dielectric value

of contents of the beer line drops below a value in the range of 10.0 to 20.0.

8. A fob detection system as claimed in any preceding claim, wherein the capacitive sensor has an operating frequency in the range of 2 to 5 KHz.

9. A fob detection system as claimed in any preceding claim, wherein means are provided for adjusting sensitivity of the capacitive sensor by providing for adjustment of negative feedback between an amplifier and an oscillator driving a capacitive electrode.

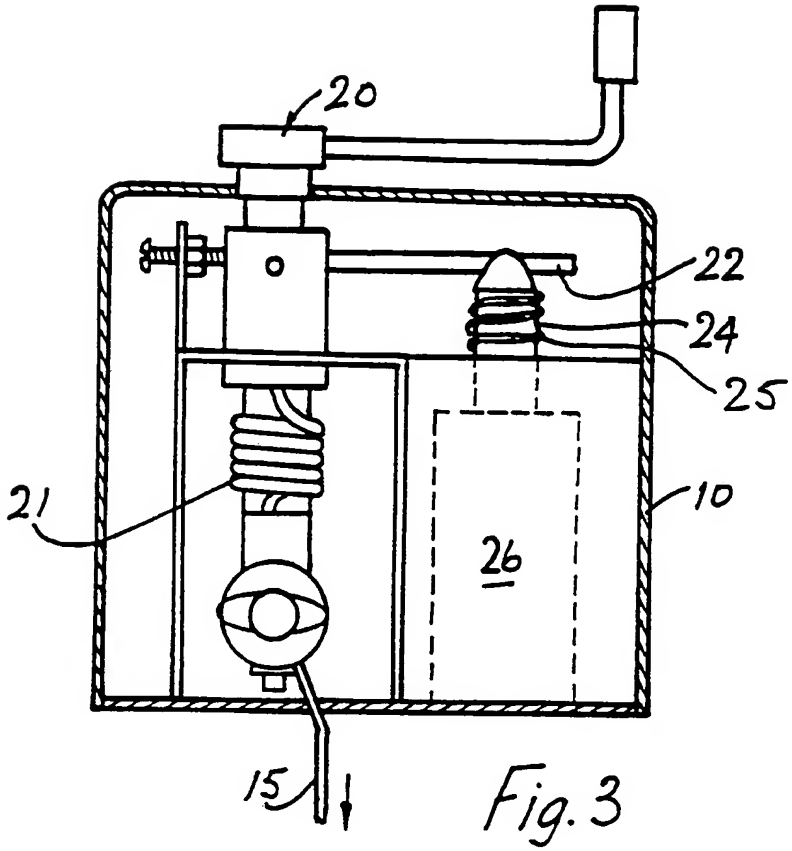

Fig. 3

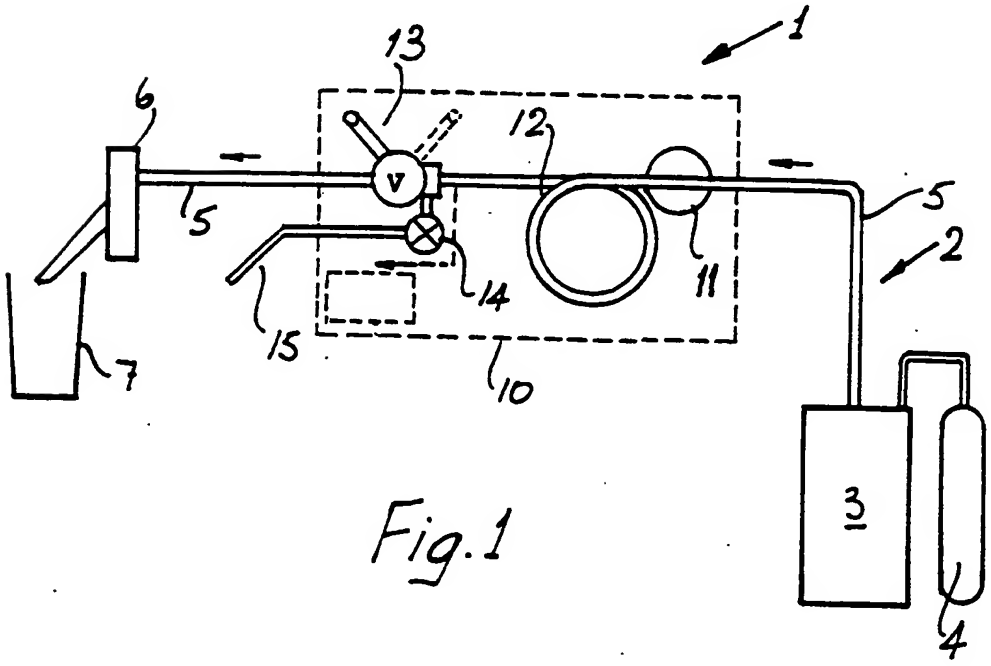

Fig. 1

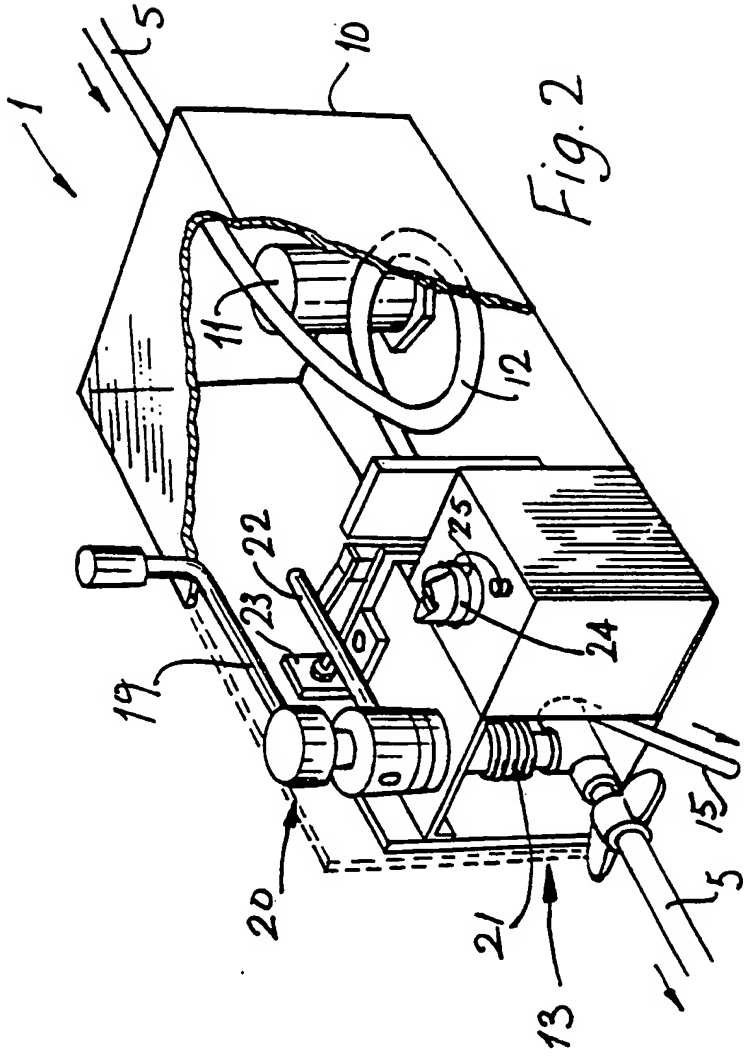

Fig. 2

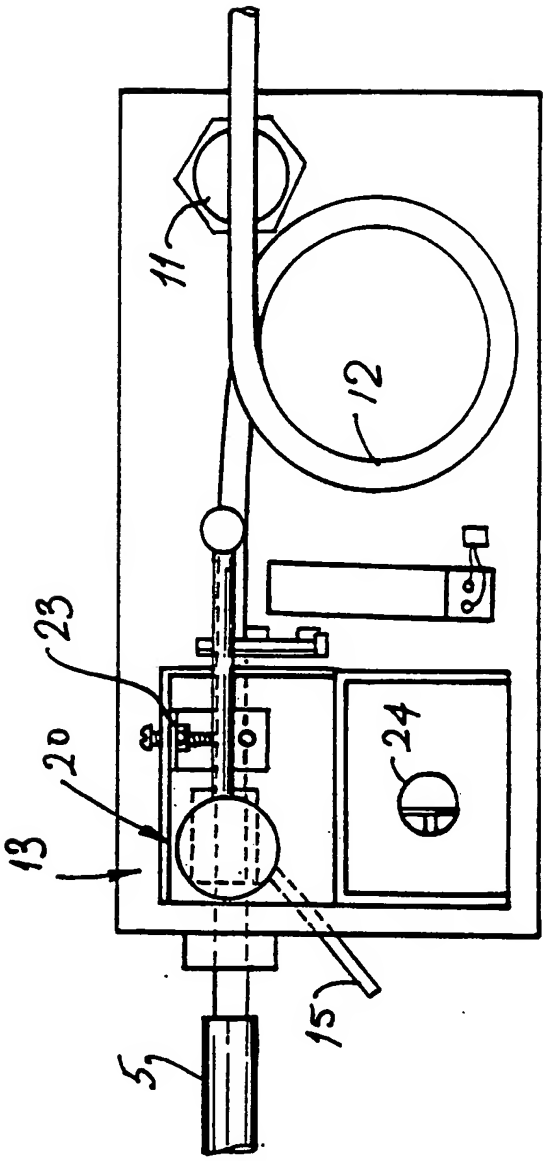

Fig.4

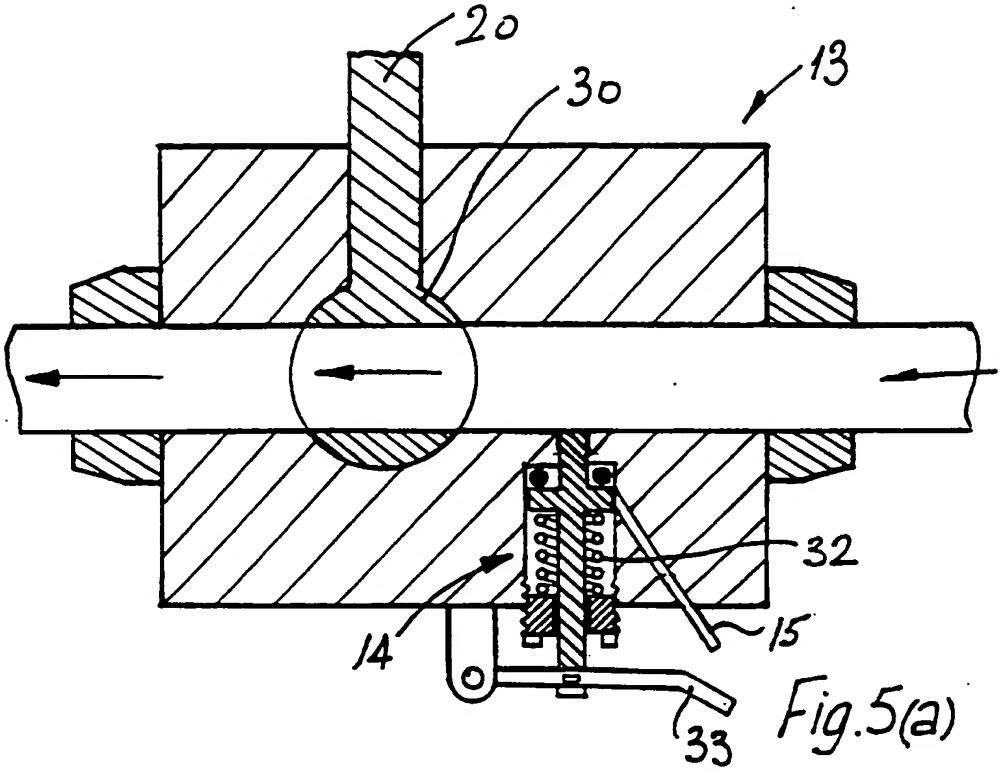

Fig.5(a)

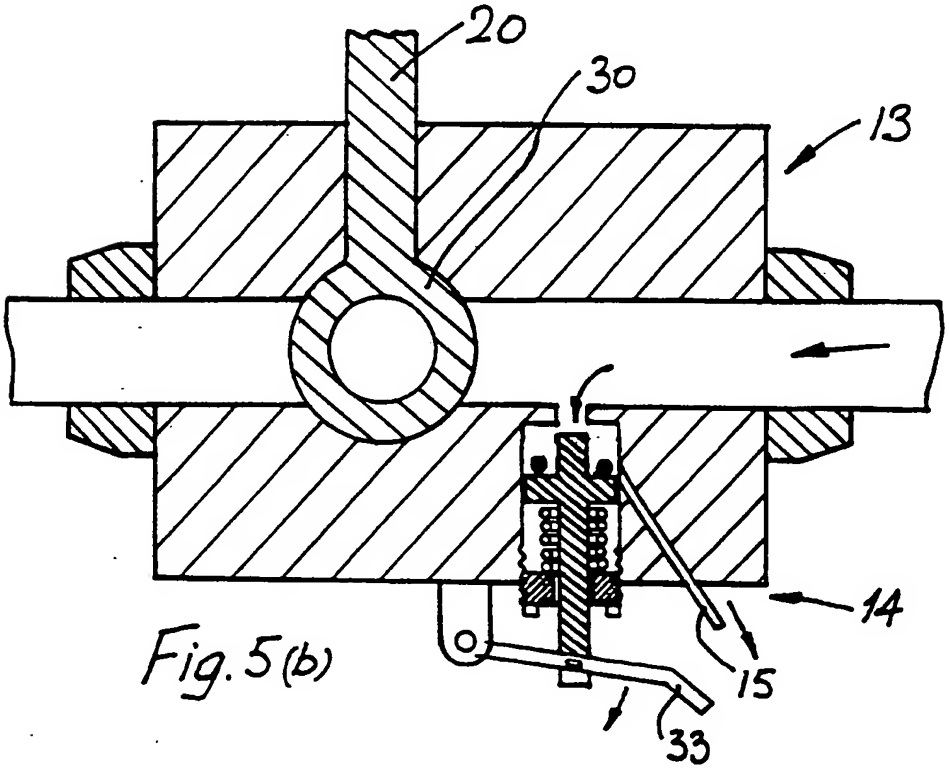

Fig. 5(b)

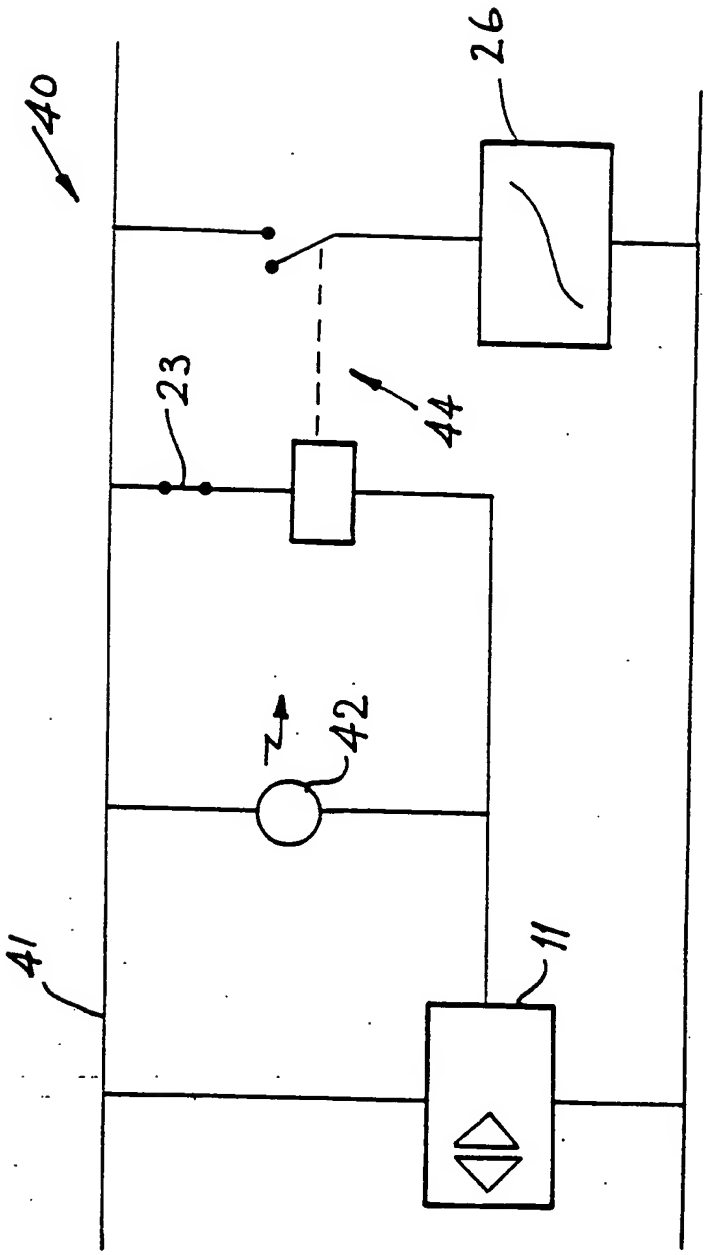

Fig. 6 (a)

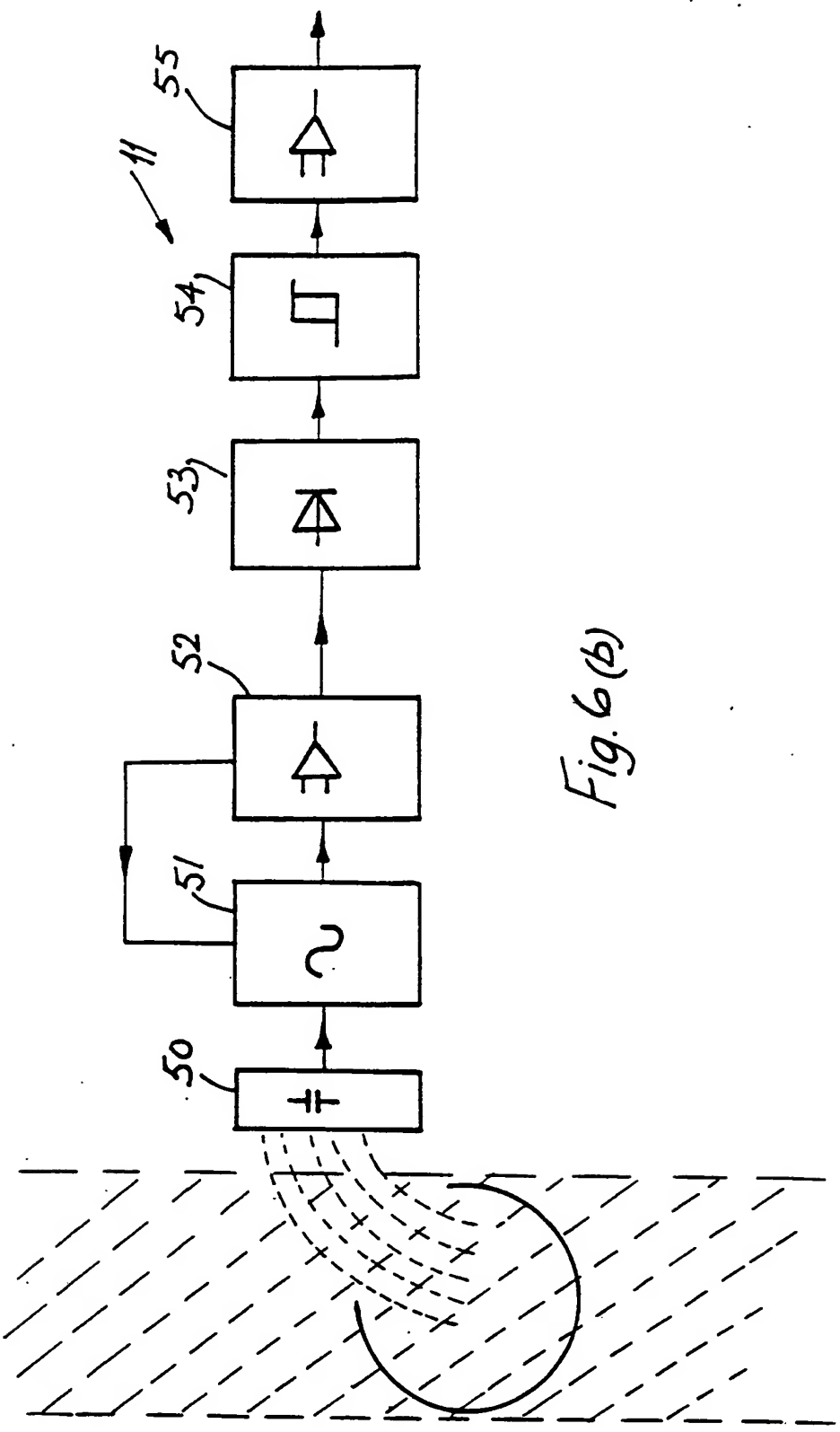

Fig. 6 (b)

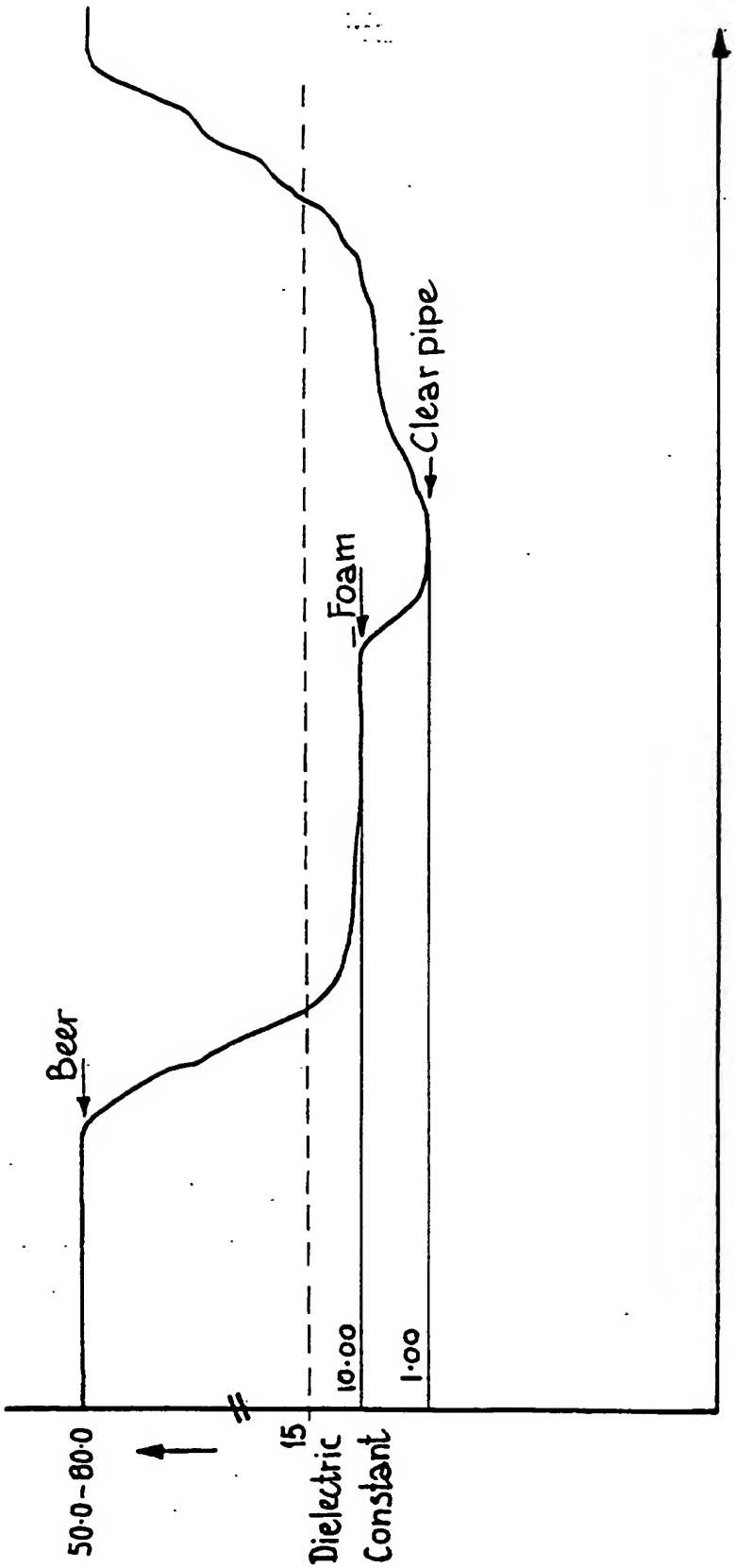
Beer
Foam
Clear pipe
50·0-80·0
15
Dielectric Constant
10·00
1·00
Time

Fig. 7

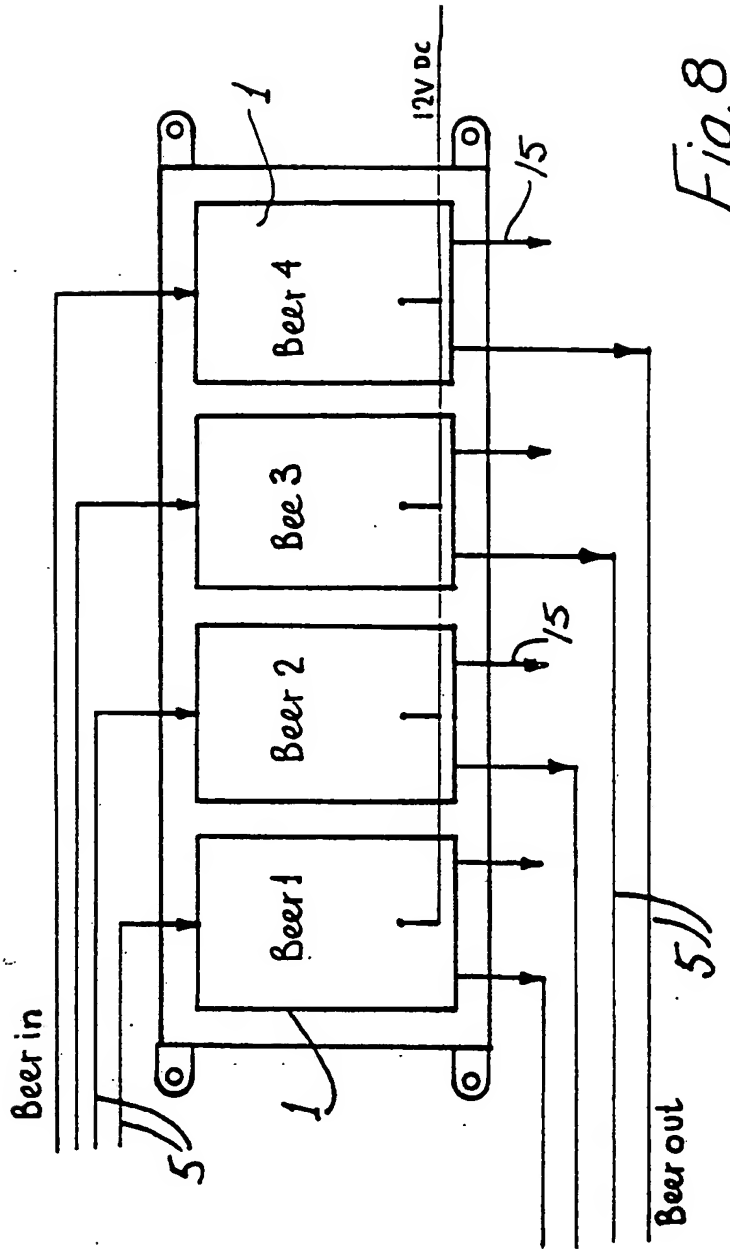

Fig. 8

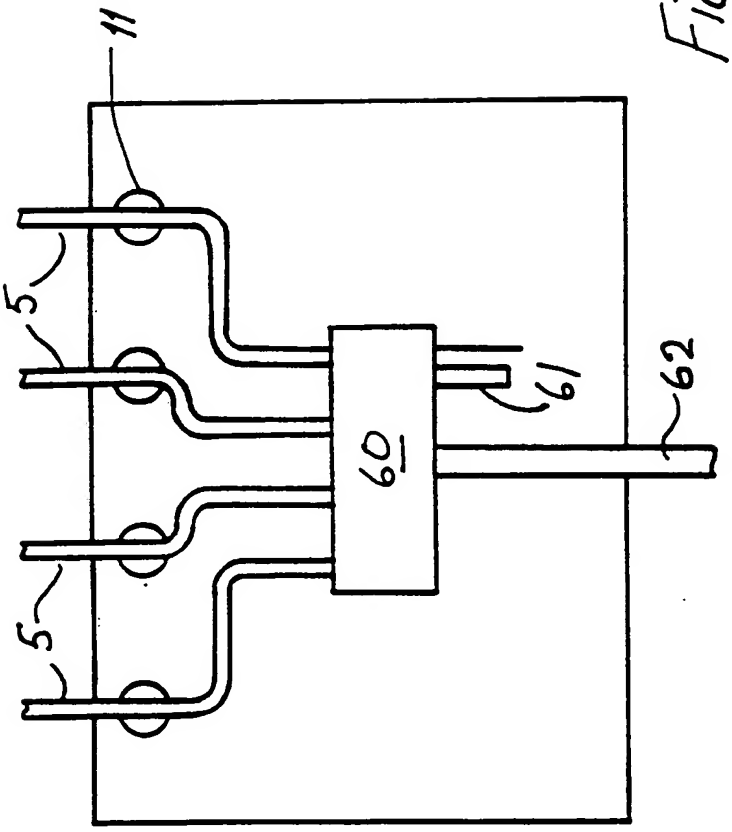

Fig. 9

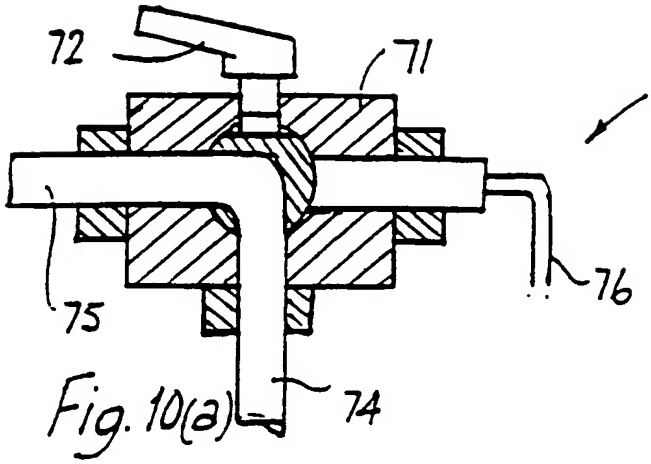

Fig. 10(a)

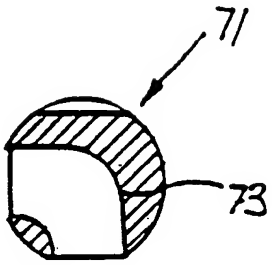

Fig. 10(d)

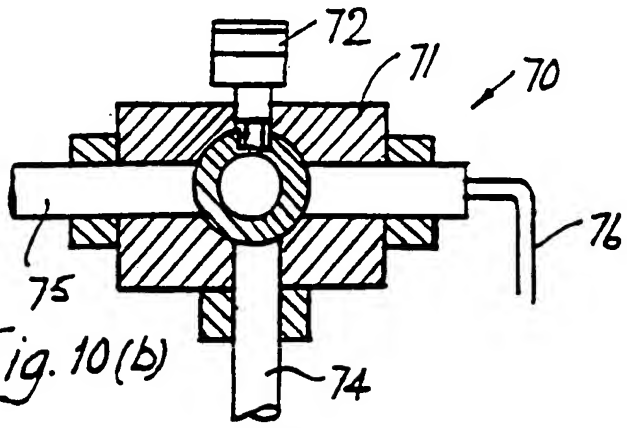

Fig. 10(b)

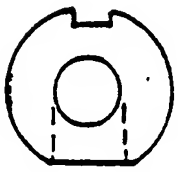

Fig. 10(e)

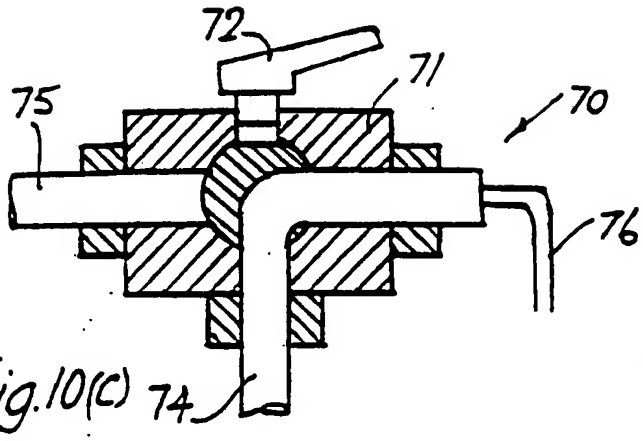

Fig. 10(c)

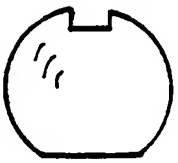

Fig. 10(f)

INTERNATIONAL SEARCH REPORT

International Application No PCT/IE 93/00025

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B67D1/12; G01F23/26

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B67D ; G01F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
Y	GB,A,1 360 602 (PRIESTLY) 17 July 1974 see claim 1	1,2,5, 7-9
Y	FR,A,2 286 368 (FABRE) 23 April 1976 see claim 1; figure 1	1,2,5, 7-9
A	US,A,5 012 683 (DAVIS) 7 May 1991	
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Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
02 JULY 1993	08. 07. 93
International Searching Authority	**Signature of Authorized Officer**
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

IE 9300025
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-1360602	17-07-74	None	
FR-A-2286368	23-04-76	None	
US-A-5012683	07-05-91	EP-A- 0438159	24-07-91
		JP-A- 4218726	10-08-92
DE-A-2927066	17-01-80	AU-A- 4873979	10-01-80
		BE-A- 877551	05-11-79
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